

# PATENT ABSTRACTS OF JAPAN

(11)Publication number : 08-280009

(43)Date of publication of application : 22.10.1996

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(51)Int.Cl. H04N 7/24  
G06T 9/00  
H03M 7/30  
H04N 5/92  
// G11B 7/00

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## (54) IMAGE ENCODERIMAGE DECODER AND OPTICAL DISK

### (57)Abstract:

PURPOSE: To provide the image encoder for providing a compressed image having high picture quality and the image decoder for decoding those encoded data.

CONSTITUTION: A still picture discriminating means 202 for discriminating whether an input image is a still picture or not a frame erasing means 203 for erasing a frame from the input still picture and an encoding means 205 for performing variable length encoding are provided. When the input image is discriminated as the still picture the frame at one part of the input image is erased and when data are not valid the operation of the encoding means is stopped. Beside the decoder is provided with a frame restoration information detecting means for extracting the information on frame restoration out of the data decoding means 402 for decoding the variable length code and frame restoring means 403 for outputting the image after inserting the frame to it. According to the information detected by the frame restoration information detecting means the input operation of the decoding means 402 is stopped and the frame restored by the frame restoring means 403 is outputted.

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## CLAIMS

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[Claim(s)]

[Claim 1] When it has the following and said inputted image is judged to be a still picture delete some frames of said inputted image which constitutes a still picture

from said frame deleting means and said encoding means is received. An image encoding apparatus which sends a data effective signal which shows whether data is effective and is characterized by interrupting operation of said encoding means when data is not effective.

A still picture judging means which judges whether it is an image encoding apparatus which performs compression encoding of a picture using variable length coding and an inputted image is a still picture.

A frame deleting means which deletes a frame from an inputted image.

An encoding means which performs variable length coding.

[Claim 2] The image encoding apparatus according to claim 1 characterized by deleting the m frame (integer with which  $m: 1 \leq m < n$  is filled) when a still picture which carries out n frame (n is two or more integers) continuation is inputted in a frame deleting means.

[Claim 3] The image encoding apparatus according to claim 1 characterized by deleting a frame of up to [ from the 2nd frame ] the n frame when a still picture which carries out n frame (n is two or more integers) continuation is inputted in a frame deleting means.

[Claim 4] The image encoding apparatus according to claim 1 deleting only one frame and outputting a still picture of two frames when a still picture which continues three frames is inputted in a frame deleting means.

[Claim 5] The image encoding apparatus according to claim 1 deleting only one frame and outputting a still picture of four frames when a still picture which continues five frames is inputted in a frame deleting means.

[Claim 6] An image decoding device which is provided with the following interrupts input operation to said decoding means according to information detected by said frame restoration information detection means and is characterized by outputting a frame restored by said frame restoring means.

A frame restoration information detection means which takes out information about frame restoration out of data which is an image decoding device which decrypts a picture coded using variable length coding and was coded using variable length coding.

A decoding means which decodes a variable length code.

A frame restoring means which inserts and outputs a frame to an outputted image from said decoding means.

[Claim 7] When it has the following and said inputted image is judged to be a still picture delete some frames of said inputted image which constitutes a still picture from said frame deleting means and said encoding means is received. An optical disc which sends a data effective signal which shows whether data is effective and is characterized by recording information coded by an image encoding apparatus which interrupts operation of said encoding means when data is not effective. A still picture judging means which judges whether an inputted image is a still picture.

A frame deleting means which deletes a frame from an inputted image.  
An encoding means which performs variable length coding.

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## DETAILED DESCRIPTION

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[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the image encoding apparatus which codes a video signal using variable length coding and the image decoding device which decrypts the video signal coded using variable length coding.

[0002]

[Description of the Prior Art] The technique of compressing a prolonged video signal into these archive media and recording it is examined with development of a digital storage medium. Also in International Organization for Standardization (ISO) the standardization activity of the video coding mode is performed by MPEG (Moving Picture Image Coding Experts Group) of International Electrotechnical Commission (IEC). For example, there is "ISO/IEC 11172" etc.

[0003] In coding of MPEG, relative redundancy is dropped on both a time-axis and a space axis, and the amount of information is reduced. In order to drop the relative redundancy of space shaft orientations, DCT (Discrete Cosine Transform) quantization and variable length coding are used. On the other hand, in order to drop the relative redundancy of a time base direction, coding of the inter-frame difference using correlation of the frame and the coding using a motion vector are used. I-Picture is coded only within a frame by MPEG without taking other frames and correlation. There are three Picture types: P-Picture coded using the prediction from the past Picture and B-Picture coded using the prediction from both the past and the future. This situation is shown in drawing 1. Thus, in MPEG, compressing for the small amount of information is more possible by using inter-frame correlation and using three Picture types like drawing 1 than coding each frame within a frame respectively.

[0004]

[Problem(s) to be Solved by the Invention] The coding using three Picture types mentioned above is dramatically effective to video with correlation strong against a time base direction. However, to the still picture which carries out n frame (n is two or more integers) continuation, although the 2nd frame to eye the n frame was the completely same picture as the 1st frame, it had the technical problem that a certain amount of amount of information will be given to all the frames.

[0005] It aims at acquiring conventionally the high-definition picture by which compression encoding was carried out by this invention's solving an aforementioned problem and assigning the amount of information of the part to other frames without performing assigning the amount of information to the frame of the same picture at all in the case of a still picture.

[0006]

[Means for Solving the Problem]In order to solve an aforementioned problem an image encoding apparatus of this inventionA still picture judging means which judges whether an inputted image is a still pictureand a frame deleting means which deletes a frame from a still picture inputted imageWhen it has an encoding means which performs variable length coding and is judged with a still picture by a still picture judging meansdelete some frames of an inputted image which constitutes a still picture from a frame deleting meansand an encoding means is receivedA data effective signal which shows whether data is effective is sentand when data is not effectiveit is the composition of interrupting operation of an encoding means.

[0007]A frame restoration information detection means by which an image decoding device of this invention takes out information about frame restoration out of data coded using variable length codingIt has a decoding means which decodes a variable length codeand a frame restoring means which inserts and outputs a frame to an outputted image from a decoding meansIt is the composition which outputs a frame which interrupted input operation of a decoding means and was restored by a frame restoring means according to information detected by a frame restoration information detection means.

[0008]

[Function]By the above mentioned compositionwith the image encoding apparatus of this inventionwhen judged with it being a still picture by a still picture judging meansafter deleting a frame in a frame deleting meansit codes in an encoding means. The amount of information currently assigned to such a redundant frame with the conventional image encoding apparatus becomes unnecessarysince some frames of a still picture are deleted before codingIt becomes possible at this rate to assign many amount of information to other framesand a compression encoding picture [ high definition / before ] can be acquired.

[0009]

[Example]Hereafteraccording to a drawingthe example of this invention is described in detail.

[0010]As the 1st exampleoperation of the image encoding apparatus of this invention is explained. The block diagram of the image encoding apparatus of the 1st example of this invention is shown in drawing 2.

[0011]The inputted image 201 goes into the still picture judging means 202 and the frame deleting means 203. In the still picture judging means 202it has a memory for one frame and the difference of the frame in front of one and the present frame is taken. When it is below a predetermined value with this difference valuethe inputted picture judges with it being the same still picture as the picture of one frame agoand outputs the still picture decision signal 204 to the frame deleting means 203. In the frame deleting means 203the frame judged to be a still picture is deleted according to the still picture decision signal 204and the data effective signal 206 which shows whether data is effective is sent. According to the data effective signal 206only the period when data is effective performs the

coding which used the variable length code and the encoding means 205 outputs the output bit stream 207. It asks for the frame number deleted from the valid signal 206 of data and the information is embedded into the output bit stream 207 or the data effective signal 206 is sent to the decoding means of the next step as it is.

[0012] Drawing 3 shows the difference in the output of the image encoding apparatus of the 1st example of this invention and the conventional image encoding apparatus. When the inputted image whose frame after No.8 the frame of No.1 to No.7 is an animation in a still picture is inputted into coding equipment in conventional coding equipment. As shown in drawing 3 it assigned one Picture type of IP and B also to the still picture frame of No.1 to No.7 respectively and all the frames are coded.

[0013] On the other hand in the image encoding apparatus of this invention after deleting the still picture frames from No.2 to No.7 in order to code as shown in drawing 3 the still picture frames from No.2 to No.7 are not coded. Therefore the amount of information currently assigned to the frame of this No.2 to No.7 with conventional coding equipment is enabled to assign other frames in the image encoding apparatus of this invention and a high-definition compression encoding picture will be acquired rather than the conventional image encoding apparatus.

[0014] In this example although explained taking the case of the case where all redundant frames (frame of No.2 to No.7 of drawing 3) are deleted to a still picture it is necessary to not necessarily delete no redundant frames.

[0015] In this example although it is considered as the predetermined value about the threshold of the inter-frame difference used for the judgment of a still picture by a still picture judging means whether this predetermined value is a fixed value or is a variable value which changes for every frame it cannot be overemphasized that it can operate similarly.

[0016] Next the image decoding device of this invention is explained as the 2nd example. Drawing 4 is a block diagram of the image decoding device of this invention.

[0017] The image decoding device of this example is an image decoding device in case the bit stream of an input is inputted intermittently and a data effective signal is sent simultaneously as shown in drawing 5.

[0018] The bit stream 401 goes into the decoding means 402 decoding of a variable length code is performed and the decoded signal goes into the frame restoring means 403. The data effective signal 404 which shows whether data is effective goes into the decoding means 402 and the frame restoring means 403 and according to the data effective signal 404 when data is invalid it interrupts decryption operation for the decoding means 402.

[0019] On the other hand according to the data effective signal 404 the frame restoring means 403 also outputs the restored frame when data is invalid.

[0020] Thus the bit stream outputted with an image encoding apparatus as shown in the 1st example can also be correctly decoded by interrupting operation of decoding processing and inserting and outputting a restoration frame to an



interruption period according to a data effective signal.

[0021]Next the image decoding device of this invention is explained as the 3rd example. Drawing 6 is a block diagram of the image decoding device of this invention.

[0022]Here the example of an image decoding device in case frame restoration information is recorded into the bit stream is described.

[0023]The bit stream 601 goes into the decoding means 602 and the frame restoration information reading means 603. In the frame restoration information reading means 603 the information about frame restoration is read from the bit stream 601. According to this read information the period which performs frame restoration The transfer interruption signal 604 which interrupts operation of the decoding means 602 and interrupts sending of a bit stream to the sending area of the bit stream 601 temporarily is sent and the frame restored in the frame restoring means 605 is inserted and outputted.

[0024]Thus the bit stream outputted with an image encoding apparatus as shown in the 1st example can also be correctly decoded by interrupting operation of decoding processing and inserting and outputting a restoration frame to an interruption period according to the data restoration information embedded into the bit stream.

[0025]Although the case where operation of a decoding means was interrupted for this example was described if a bit stream is not inputted it cannot be overemphasized that you do not need to make it interrupted if it is a decoding means which freezes the present frame until the following bit stream is inputted.

[0026]Next as the 4th example operation of the image encoding apparatus of this invention is explained. The block diagram of the image encoding apparatus of the 4th example of this invention is the same as that of the image encoding apparatus of the 1st example shown in drawing 2. Operation of the frame deleting means 203 differs from the 1st example.

[0027]When decoding the bit stream coded with the image encoding apparatus of the 1st example the information what frame of which still picture frame was deleted must be received from the inside of a bit stream or the exterior and decoding operation must be controlled according to the information. For this reason as the 2nd and 3rd example described the device for reading the information what frame of which still picture frame was deleted is needed.

[0028]This example explains the image encoding apparatus which such a special device is not needed by the image decoding device side and can obtain a compressed image [ high definition / image encoding apparatus / conventional ].

[0029]There is a parameter for the 3-2 pulldown method of presentation which changes a film image (frame frequency of 24 Hz) into the usual video signal (frame frequency of 30 Hz) and outputs it in an MPEG standard. This is two parameters stop\_field\_first (it abbreviates to TFF hereafter) and repeat\_first\_field (it abbreviates to RFF hereafter).

The output of a decoding device with this parameter becomes like drawing 7.

When TFF is "H" first\_field (subscript of f in drawing 7) is outputted previously and in

"L" second\_field (subscript of s in drawing 7) is outputted previously. On the other hand when RFF is "H" field previously outputted according to TFF is outputted repeatedly. Thus display conversion to the usual video signal [ film image / (frame frequency of 24 Hz) ] (frame frequency of 30 Hz) is performed. Restoration of a frame is attained even if it does not prepare a special information reader by the image decoding device side by using this parameter to the information on a deletion frame. The situation of conversion is shown in drawing 7.

[0030] Operation of the image encoding apparatus of this example is explained referring to drawing 8. As shown in drawing 8 when the still picture which continues to the frame of No.1 to No.12 is inputted the still picture judging means 202 is judged from No.2 to be a still picture. In the frame deleting means of this example after the still picture judging means 202 judges with a still picture only when a frame is counted and a count is set to 4 a data effective signal is dropped on "L" and a counter is reset. Simultaneously the memory which has memorized the frame in front of one to the judgment within the still picture judging means 202 is reset. Thereby since the data for a judgment is reset the frame of No.6 is not judged to be a still picture but is again judged from the frame of No.7 to be a still picture. Thus in the image encoding apparatus of this example when a continuous still picture is inputted it codes by deleting the picture of one frame every five frames. Under the present circumstances as shown in drawing 8 TFFRFF is inputted to an encoding means and in an encoding means this TFFRFF is embedded at an output bit stream and is outputted.

[0031] Thus by deleting one frame every five frames to the continuous still picture the amount of information currently conventionally assigned to this frame is enabled to assign other frames and a compression encoding picture [ high definition / image encoding apparatus / conventional ] is acquired. It is possible to decode even if it does not have a special information reader by the decoding device side since frame deletion which can be decoded using the information on TFFRFF is performed.

[0032] Although this example explained taking the case of the case where one frame is deleted every five frames as shown in drawing 9 even if it deletes one frame every three frames it cannot be overemphasized that it can operate similarly.

[0033] Next the optical disc of this invention is explained as the 5th example. The optical disc in the 5th example of this invention is an optical disc which is recording the information coded with the image encoding apparatus as shown in drawing 2. The optical disc of this invention is recording the higher-definition picture to the optical disc which records the information coded with the conventional image encoding apparatus. The optical disc of this example by using the amount of information distributed with the image encoding apparatus of this invention for the improvement in image quality for the improvement in the record time in the conventional optical disc. It is dramatically effective also as an optical disc which it becomes possible to record the prolonged information which was not able to be recorded and records prolonged picture information.

[0034] As mentioned above if the image encoding apparatus and image decoding

device which were described in the 1st to 4th example are used a compression encoding picture [ high definition / image decoding device / the conventional image encoding apparatus and ] can be acquired.

[0035]It cannot be overemphasized that it can operate similarly about the device made combining the device described in the 1st to 4th example.

[0036]

[Effect of the Invention]The still picture judging means the image encoding apparatus of this invention judges whether an inputted image is a still picture to be as mentioned aboveWhen it has a frame deleting means which deletes a frame from an inputted imageand an encoding means which performs variable length coding and is judged with a still picture by a still picture judging meansafter deleting some frames of the frame which constitutes a still picture from a frame deleting meansit is the composition which codes by an encoding means.

[0037]The amount of information currently conventionally assigned to the continuous still picture frame by this can be deletedit becomes possible to assign this amount of information to other framesand a compression encoding picture [ high definition / before ] can be acquired.

[0038]A frame restoration information detection means by which the image decoding device of this invention takes out the information about frame restoration out of the data coded using variable length codingIt has a decoding means which decodes a variable length codeand a frame restoring means which inserts and outputs a frame to the outputted image from a decoding meansIt is the composition which outputs the frame which interrupted the input operation of the decoding means and was restored by said frame restoring means according to the information detected by the frame restoration information detection means.

[0039]Therebyrestoration becomes possible as [ bit stream / which was coded with the image encoding apparatus of this invention ] usual.

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## DESCRIPTION OF DRAWINGS

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[Brief Description of the Drawings]

[Drawing 1]The figure of arrangement of the frame of an MPEG system

[Drawing 2]The block diagram of the image encoding apparatus of the 1st example of this invention

[Drawing 3]The figure showing operation of the image encoding apparatus of the 1st example of this invention

[Drawing 4]The block diagram of the image decoding device of the 2nd example of this invention

[Drawing 5]The figure showing the input of the image decoding device of the 2nd example of this invention

[Drawing 6]The block diagram of the image decoding device of the 3rd example of this invention

[Drawing 7]3-2 of MPEG -- the figure showing the pulldown method of



presentation

[Drawing 8] The figure showing operation of the image encoding apparatus of the 4th example of this invention

[Drawing 9] The figure showing operation of the image encoding apparatus of the 4th example of this invention

[Description of Notations]

201 Inputted image

202 Still picture judging means

203 Frame deleting means

204 Still picture decision signal

205 Encoding means

206 Data effective signal

207 Output bit stream

401 Input bit stream

402 Decoding means

403 Frame restoring means

404 Data effective signal

601 Input bit stream

602 Decoding means

603 Frame restoration information reading means

604 Transfer interruption signal

605 Frame restoring means

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